"Long-term Shallow Groundwater Studies in the Coastal Plain: Opportunities and Challenges"

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Long-term shallow water table elevations may have implications to contemporary flooding, water supply, wetland and habitat restoration, and water quality issues besides sea level rise and saltwater intrusion, as well as potential climate change on the coastal plain. The coastal plain is comprised of a variety of soils and landforms associated with ancient sea levels (Colquhoun 1974). The most common characteristics of these landforms are low slopes and broad inter-stream divides (Buol 1976). High rates of both rainfall and evapotranspiration (ET) (Muller and Grymes 1994) result in rapid changes from flooding to drought as the balance shifts slightly from year to year. Although measuring ground water table position in the coastal plain requires little technology, relating those measurements to long term average conditions is a greater challenge.

Since the climatologic drivers of rain and ET are variable, direct measures of ground water table must be repeated over a sufficiently long period to sample these variations. Soil development naturally integrates climatic variation and soil scientists insist that soil drainage characteristics can be used to estimate average water table depth. In this paper we will outline two studies that relate long-term water table measurements to soil mapping and classification characteristics on naturally drained forests. We relate average water table depth to hydrologic soil group, soil drainage class, and soil taxonomy. The two studies evaluated 14 soil series with three years of daily measurement on five soils and 14 years of weekly measurement on nine soils for water table depths. Studies were conducted near Georgetown, SC and on the Francis Marion National Forest (FMNF) near Huger SC.

Table 1 lists results of both studies in a single table. The data from the Georgetown study are a subset of data included in tables in Williams (2006) where a more complete description of that study can be found. Similarly, the FMNF data are reported in Amatya et al. (2009).

Long term studies of shallow water table depths demonstrate that soil characteristics are indicative of water table depth. The taxonomic soil description is generally most informative, and drainage classes can be compared within a soil order. This is demonstrated from both spodosols and utisols. Hydrologic soil group does not relate well except for well to excessively well drained sands which are all of group A. Measurements of water table require at least one year of average rainfall. Any number of consecutive years of average rainfall also can be used. Generally any five consecutive years will approximate the long term average. Most of these conclusions are based on data from the 20th century and may be altered by climate change.

Table 1. Soil characteristics and long term average water table depth for 14 South Carolina Coastal soils. Soils listed are from two separate studies, those with * include data from 2005-2009 while others are from data from 1975-1989.

Series	Hydrologic Soil Group	Drainage Class	Taxonomic Name	Average Water Table Depth (cm)	Standard deviation
Centenary	A	Well drained	Entic Grossareanic Alorthod	93	38.4
Chipley	C	Somewhat poorly drained	Aquic Quartzipsamments	103	49.7
Echaw	A	Moderately well drained	Oxyaquic Alorthod	90.0	61.1
Goldsboro*	B	Moderately well drained	Aeric Paleudult	121.0	84.3
Hobcaw	Not listed	Very poorly drained	Typic Umbraaquults	53	38.8
Lakeland	A	Excessively well drained	Typic Quartzipsamments	209	67.9
Lenoir*	D	Somewhat poorly drained	Aeric Ochraaquults	34.8	35.2
Leon	Not listed	Poorly drained	Aeric Alaquods	58	41.0
Lynchburg*	C	Somewhat poorly drained	Aeric Paleaquults	57.9	49.9
Lynn Haven	B/D	Very poorly drained	Typic Alaquod	44	34.5
Rains*	B/D	Poorly drained	Typic Paleaquults	43.8	54.5
Wahee*	D	Somewhat poorly drained	Aeric Ochraaquults	87.6	88.0
Witherbee	Not listed	Somewhat poorly drained	Aeric Alaquod	56	38.8
Yauhannah	B	Moderately well drained	Aquic Hapludults	120	59.3

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